CLAIMS

1. A synchronous electric machine (M), comprising an armature (A) and an inductor (B) between which is defined an air gap (G);

the armature (A) having at least one pair of poles (N, S);

the inductor (B) having, for each pair of poles (N, S) of the armature (A), n identical ferromagnetic tooth structures (20) and n slots (21), alternating with one another and each having at the air gap (G) a respective, essentially constant, extent in the direction of relative displacement between inductor (B) and armature (A); the inductor (B) being provided with a winding (W) housed in the said n slots; the machine (M) being characterised in that:

the surface of the armature (A) facing the air gap (G) is divided into 2N elements or samples (1-12), with N being an integer multiple of n, having substantially the same extent in the said direction of relative displacement;

each of the said ferromagnetic tooth structures of the armature having at the air gap a sequence of teeth (20a) of substantially constant extent along the said direction of relative displacement, separated by at least one pseudoslot (21a), so that the surface of the inductor for each pair of poles has at the air gap overall N teeth (20a) separated by N intervals, of which n are constituted by the openings to the air gap of the said n slots and (N-n) are constituted by the openings to the air gap of the said pseudoslots (21a);

each sample (1-12) of the armature (A) having a respective magnetic potential value (τ_i) essentially constant over the extent of the sample;

each sample (1-12) of the armature (A) is associated with a respective total value of magnetic permeance (p_i) at

the air gap (G) in a predetermined alignment condition or relative position between the inductor (B) and the armature (A) in which the sample extends between the axis of one tooth and the intermediate axis between this tooth and an adjacent tooth at the air gap (G);

the armature (A) includes a plurality of magnetically distinct bodies (30, 31, 32; ...) of ferromagnetic material, each of which couples at least two armature samples in such a way as to ensure a substantial magnetic equipotentiality;

the magnetic potentials (τ_i) of the single samples (1-12) of the armature (A) and the said values of total magnetic permeance (p_i) associated with them being determined according to predetermined criteria.

2. An electric machine according to Claim 1, in which, having assigned to the armature samples (1-12) respective even and odd positions alternately on the surface facing the air gap (G) along the said direction of relative displacement, for each body (31, 32; ...; 101, 102) of the armature (A) having magnetic potential (τ) substantially different from zero the sum of the total magnetic permeances (p_x) of the samples in even positions is substantially equal to the sum of the total magnetic permeances (p_y) of the samples in odd positions.

3. An electric machine according to Claim 1 or Claim 2, in which the armature (A) comprises at least one ferromagnetic body defined as "odd" (30; 40; 51; ...; 101) which faces the air gap (G) through two non-contiguous sets of samples, each of which comprises an odd number of contiguous samples (1).

4. An electric machine according to any preceding claim,

in which the inductor (B) is formed in such a way that it is able to generate a magnetomotive force distribution which is seen by the armature (A) identically in all relative positions which are separated from one another by one slot pitch (P), and

in which in the 2N/n possible alignment conditions for each sample (1-12) in a slot pitch (P), the values of all the magnetic parameters (L_o, L_m, L_{om}, Ψ_o, Ψ_m) of the electric machine calculated in the components along two separate axes ($\underline{o}$, $\underline{m}$) for example in quadrature with one another, fixed to the armature, are substantially equal to one another in the said 2N/n alignment conditions.

5. An electric machine according to Claim 4, in which:

$$L_{o,K} \cong cost$$

$$L_{m,k} \cong cost$$

$$L_{om,k} \cong cost$$

$$\Psi_{o,k} \cong cost$$

$$\Psi_{m,k} \cong cost$$

with k = 1, 2, … 2N/n

in which:

$L_{o,k}$ are the values of self-inductance measured, in the said 2N/n alignment conditions, along a first axis ($\underline{o}$) corresponding to the armature (A) pole separation axis (N, S);

$L_{m,k}$ are the self-inductance values measured, in the said 2N/n alignment conditions, along a second axes ($\underline{m}$) in quadrature with the separation axis ($\underline{o}$) of the poles (N, S) of the armature (A);

$L_{om,k}$ are the mutual coupling values between magnetomotive forces and fluxes along the said first and second axes ($\underline{o}$, $\underline{m}$) in the said 2N/n alignment conditions;

$\Psi_{o,k}$ are the values of the flux linked by the windings (W) of the inductor (B) along the said first axis ($\underline{o}$) in the said 2N/n alignment conditions; and

$\Psi_{m,k}$ are the values of the flux linked by the windings (W) of the inductor (B) along the said second axis ($\underline{m}$) in the said 2N/n alignment conditions.

6. An electric machine according to any preceding claim, in which the teeth of the inductor (B) have, at the surface facing the air gap (G), an extent which, along the said direction of relative displacements, has a magnitude close to 3/4 or 7/8 of the tooth pitch.

7. An electric machine according to any of Claims 1 to 5, in which the armature (A) comprises at least two axial armature portions which are offset from one another in the said direction of relative displacement.

8. An electric machine according to Claim 7, in which the said at least two portions of the armature (A) have respective different transverse sections.

9. An electric machine according to Claim 8, in which the said at least two portions of the armature (A) have respective different axial lengths.

10. A machine according to any of Claims from 7 to 9, in which two portions of the armature (A) are offset from one another by about one quarter of the tooth pitch of the inductor (B).

11. An electric machine according to any of Claims from 7 to 10, in which the armature (A) comprises four axial armature portions, which in the said direction of relative displacement are offset from one another by 1/8 of the tooth pitch.

12. An electric machine according to any preceding claim, dimensioned to deliver in operation a maximum predetermined torque (T_M), and in which the armature (A) is formed in such a way that when the machine (M) operates delivering a torque close to the said maximum torque (T_M), in each of the 2N/n possible alignment conditions for each sample in a slot pitch the distribution of induction in the ferromagnetic tooth structures (20) of the inductor (B) has values substantially close to, and preferably less than, the saturation induction value of the ferromagnetic tooth structures (20) of the inductor (B) over at least half of the pole pitch of the armature (A), and preferably not more than 3/4 of the pole pitch of the armature (A).

13. A synchronous electric machine according to Claim 12, in which in each of the said alignment conditions the said distribution of induction is substantially in quadrature with the distribution of magnetic potential generated by the inductor (B) at the said ferromagnetic structures of the inductor (B).

14. A synchronous electric machine according to Claim 12 or Claim 13, in which in each of the said alignment conditions the said distribution of induction has a substantially monotonically increasing variation over an extent equal to about one pole pitch of the armature (A) and a substantially

monotonically decreasing variation for the subsequent or preceding pole pitch.

15. An electric machine according to any preceding claim, in which the distribution of the magnetic permeance values (p_i) at the air gap (G) associated with the armature samples has a local minimum in a field which extends for a width equal to three samples about the axis (o) or each pole separation axis of the armature, being such axis or each pole separation axis coinciding or being close, within more or less one sample, to the axis along which the maximum self- inductance value present at the terminals of the inductor winding is found.

16. A synchronous electric machine according to Claim 15, in which the values of magnetic permeance (p_i) at the air gap (G) increase along the air gap (G) in both directions starting from the said local minimum; this distribution of magnetic permeance (p_i) having the absolute maximum value at armature samples lying between the said or each armature pole separation axis (o) and the adjacent axes (m) which are in quadrature with the said armature pole separation axis (o).

17. An electric machine according to any preceding claim, in which each pole axis (m), in quadrature with each pole separation axis (o) is an axis of geometrical and magnetic symmetry.

18. An electric machine according to Claim 17, in which each pole axis (m) and each pole separation axis (o) is an axis of geometrical and magnetic symmetry.

19. An electric machine according to Claim 17, in which each axis (o) is not an axes of geometric and magnetic symmetry.

20. An electric machine according to any of Claims from 1 to 16, in which each pole axis (m) and each pole separation axis (o) is not an axis of geometric and magnetic symmetry but the armature is geometrically and magnetically symmetrical with respect to its axis.

21. An electric machine according to any preceding claim, in which each ferromagnetic inductor structure has one or at most two pseudoslots.

22. An electric machine according to Claim 21, in which n=3 and N=9.

23. An electric machine according to Claim 21, in which n=4 and N=12.

24. An electric machine according to Claim 21, in which n=6 and N=12.

25. An electric machine according to Claim 21, in which n=6 and N=18.

26. An electric machine according to Claim 21, in which n=12 and N=24.